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DRAFT COMMENTS ON THE REVIEW OF HUMAN HEALTH
AND ECOLOGICAL RISK ASSESSMENTS
ARMCO RCRA FACILITY INVESTIGATION REPORT

Armco Facility in Kansas, Missouri

I. INTRODUCTION

Booz·Allen & Hamilton Inc. (Booz·Allen) under Work Assignment R07901 of Contract No. 68-W-99-009 was tasked by the U.S. Environmental Protection Agency (USEPA) Region VII to review the Human Health and Ecological Risk Assessments (HHRA and ERA, respectively) of the Armco site. The site area is approximately 860 acres, located within the Blue and Missouri River alluvial valleys in northeast Kansas City, Missouri. Land use near the site is characterized by medium to heavy industrial development; however, residential developments are located southeast and west of the site. The site is divided into eastern and western portions by Interstate Highway 435 with the western portion characterized by active industrial activities and the eastern portion by undeveloped fields. The site is currently comprised of 25 solid waste management units (SWMUs) and 4 areas of concern (AOCs). The HHRA quantitatively evaluates 14 of these SWMUs (SWMUs 2, 4, 6, 7, 8, 11, 10, 12, 13, 22, 24, 25, 27, and 33) and 3 AOCs (AOCs 1, 4, and 8); the ERA evaluates 2 SWMUs (SWMUs 4 and 12) and 1 AOC (AOC 8). The other SWMUs and AOCs were presumably eliminated from quantitative evaluation because no contamination was detected.

The review comments that follow are divided into three sections — HHRA, ERA, and Other Sections of the RCRA Facility Investigation (RFI) — comprised of two subsets each (i.e., general and specific comments). Finally, Section V summarizes the central review themes for the HHRA and ERA.

II. HUMAN HEALTH RISK ASSESSMENT, APPENDIX X

A. General Comments

1) The HHRA for the Armco facility selected chemicals for quantitative evaluation based on comparisons between maximum detected site concentrations and health-based screening values. For soil and sediment, detected chemical concentrations were compared to both default ingestion and default inhalation soil screening levels (SSLs) provided in USEPA's Soil Screening Guidance: Technical Background Document (SSL Guidance). For groundwater, detected chemical concentrations were compared to calculated volatilization screening levels, Federal Maximum Contaminant Levels (MCLs), or calculated risk-based levels (where MCLs were not

available).

Several deficiencies, including the following, were identified in this screening process:

a) Default SSLs for noncarcinogenic chemicals were not adjusted downward to account for potential additive health effects at the site. As a result, noncarcinogenic chemicals were inappropriately eliminated from quantitative evaluation in the risk assessment.

b) The assumptions used to develop the default SSLs used in the risk assessment were not adequately described, discussed, or compared to actual site conditions. The uncertainties associated with the use of default SSLs were not adequately addressed.

c) The methodology, exposure assumptions, and toxicity criteria used to recalculate or develop soil SSLs, where default values were outdated or unavailable, were not adequately presented or discussed.

d) The methodology, exposure assumptions, and toxicity criteria used to calculate groundwater volatilization screening levels and risk-based screening levels were not adequately presented or discussed.

2) The risk assessment quantitatively evaluates two potential receptors at the Armco facility: Full-Time Outdoor Workers and Temporary Excavation Workers (i.e., utility workers). Based on the current and likely future use of the site for industrial purposes, it is necessary for the risk assessment to include a quantitative evaluation of potential construction worker exposures at the site. Assuming that future construction activities could occur throughout the site, exposures to construction workers should be evaluated at all SWMUs and AOCs, unless strong rationale can be provided to eliminate specific scenarios. Construction workers differ from utility workers by having longer exposure durations, higher exposure frequencies, higher intake rates, and exposures to deeper subsurface soils and groundwater.

3) The report does not consider trespasser exposure scenarios. This is not adequately conservative because, although the western portion of the site is fenced, much of the eastern portion of the site (i.e., especially SWMU 2, SWMU 12, and AOC 8) is not and has been accessed by the public (see comment 22). Residential communities and a school exist along the southern border of the eastern portion of the site. Trespassers (typically ages 9 to 18) in this area could enter the eastern portion of the site relatively easily by heading north from Norledge Drive, down a ravine and across railroad tracks to AOC 8. This access can be limited if Rock Creek contains water; however, it is an intermittent stream that can be dry nearly nine months of the year (i.e., this was true during the last recorded gauging period from 1977–1978). The duration of trespasser exposure could be relatively high in comparison to maintenance workers since this portion of the site is unoccupied most of the year.

4) The risk assessment does not provide sufficient documentation to eliminate the evaluation of future groundwater use at the site. The risk assessment fails to identify sources of potable and industrial groundwater in the vicinity of the site, and fails to discuss the potential for off-site exposures to contaminated groundwater. Potential future exposures to groundwater should not be eliminated without appropriate supporting documentation.

5) The potential adverse health effects associated with exposures to lead at the Armco facility were not adequately addressed in the risk assessment. For the most part, the risk assessment appropriately used the methodology presented by the USEPA's Technical Review Workgroup (TRW) for Lead in 1996 (TRW Lead Guidance) to evaluate nonresidential exposures to lead at the site; however, the risk assessment did not use the default exposure parameters recommended by the TRW in this evaluation. Of greatest concern is the irregular use of a 0.005 gram/day soil ingestion rate in place of the recommended 0.05 gram/day soil ingestion rate in the lead model. The risk assessment should not depart from the default unless strong rationale can be provided that eliminates the possibility of this ingestion rate in future workers. In addition, the risk assessment uses an inappropriate blood-lead standard to evaluate lead exposures in workers. The only appropriate standard for EPA risk assessments is 10 ug/dL; the 30 ug/dL value used in the report applies only to lead industry workers who participate in a continuous blood lead monitoring progam.

B. Specific Comments

Section 2.0 Chemicals of Potential Health Concern

Section 2.1, Paragraphs 1 and 2, Page 2-1

6) Paragraphs 1 and 2 indicate that utilities are installed no deeper than 8 feet on site and, therefore, exposures to subsurface soil and groundwater at depths below 8 feet were not evaluated in the risk assessment. Assuming that construction activities supporting industrial expansion, building alterations, and development of the South Riverfront Expressway could occur under future industrial land-use conditions at the Armco facility, the risk assessment should include an evaluation of subsurface soil and groundwater located at depths up to 10 feet below ground surface (bgs). The text should be modified to address potential construction activities at the site and include an appropriate subsurface soil and groundwater evaluation.

Section 2.2, Paragraph 1, Page 2-2

7) The text states, "Specific information regarding the collection of data can be obtained from the RFI Report." This statement should be expanded to clearly identify the supporting information presented in the RFI Report that is essential to the Risk Assessment Report. At a minimum, the

text should be revised to indicate that Sections 5.0 through 24.0 of the RFI Report identify the samples collected at each SWMU or AOC; provide sample information, including sample number, location, and depth; and summarize analytical data. In addition, the data sets in Sections 5.0 through 24.0 should be revised according to comment 70.

Section 2.3, Paragraph 1, Page 2-3 and Table 2-1

8) The text indicates that concentrations of chemicals detected in soil or sediment were screened against both the ingestion and inhalation SSLs developed by USEPA. The direct application of default SSLs provided by USEPA as screening levels in the risk assessment does not ensure adequate protection against the potential additive health effects associated with noncarcinogenic chemicals at the site. As stated in the SSL Guidance, page 5, "the potential for additive effects [due to noncarcinogenic chemicals] has not been "built in" to the SSLs through apportionment." Rather, the SSL Guidance (page 14) indicates that the potential for additive effects must be carefully evaluated at every site by considering the total hazard index (HI) for noncarcinogenic chemicals affecting the same target [organ]. Further, the SSL Guidance (page 32) states: "Given the currently available criteria, noncarcinogenic contaminants should be grouped according to the critical effect listed as the basis for the RfD/RfC. If more than one chemical detected at a site affects the same target organ/system, SSLs for those chemicals should be divided by the number of chemicals present in the group."

A review of the chemicals detected at the Armco facility shows numerous chemicals sharing the same target organ or critical effect. Based on the Soil Screening Guidance, the risk assessment should be modified to appropriately adjust the default SSLs used for screening purposes.

9) The text states, "Because SSLs were developed to be protective of residential populations they represent a conservative screening tool for an industrial site, such as Armco." The text should be modified to indicate that, in addition to being calculated using residential exposure parameters, the default soil inhalation SSLs provided by USEPA, were also calculated using an assumed particulate emission factor (PEF) of 1.32×10^9, based on a 0.5 acre source area and a 50 percent vegetative cover. The assumptions used to calculate the default PEF should be compared to actual site conditions at the Armco facility. As discussed in SSL Guidance, page 6, generic SSLs based on a 0.5 acre source are likely to be protective of larger source areas. The risk assessment should discuss the uncertainty associated with the evaluation of source areas smaller than 0.5 acre. In addition, the risk assessment should discuss the relevance of the assumed 50 percent vegetative cover to each SWMU and AOC (i.e., while the western portion of the site is mostly paved, the eastern portion is largely unpaved and may be sparsely vegetated).

10) The text states, "SSLs for benzo(a)pyrene, chlorobenzene, naphthalene, chromium III, and chromium VI were recalculated or developed based on new or newly available toxicity values.

For chemicals without previously published SSLs, SSLs were calculated following the SSL guidance if toxicity values were available." As indicated below, this statement is inconsistent with data provided in Table 2-1. In addition, the text should specify the methodology, exposure assumptions, and toxicity criteria used to calculate the SSLs. Specific issues are as follows:

a) According to footnote "h" on Table 2-1, soil SSLs were recalculated or developed for 2-butanone, chlorobenzene, 2-hexanone, 4-methyl-2-pentanone, 1,1,1-trichloroethane, dibenzofuran, 2-methylnapthalene, 4-methylphenol, napthalene, and trivalent chromium. The text should be modified to indicate that SSLs were recalculated or developed for each of these chemicals.

b) A review of Table 2-1 indicates that a soil inhalation SSL was also developed for benzo(a)pyrene. This chemical should be footnoted on Table 2-1. The text should be modified to reflect the development of this SSL.

c) A review of Table 2-1 indicates that the soil SSLs for barium and benzene were obtained directly from the SSL Guidance and were not recalculated based on updated toxicity criteria available for these chemicals in USEPA's Integrated Risk Information System (IRIS). The text should be modified to reflect the development of these SSLs, and Table 2-1 should be modified to reflect appropriate SSLs values.

d) Section 2.3 does not specify the methodology or exposure assumptions used to recalculate or develop new soil SSLs. The text should be modified to reference the specific equation numbers provided by the SSL Guidance used to calculate SSLs. The text should indicate whether the default exposure parameters provided by the USEPA, were used in these calculations.

e) Section 2.3 does not identify the toxicity criteria used to recalculate or develop new soil SSLs. Section 2.3 should be modified to include a table showing the value and source of all oral and inhalation toxicity criteria used to recalculate or develop soil SSLs used in the risk assessment.

11) The data presented in Table 2-1 suggest that the ingestion and inhalation soil SSLs for benzo(a)pyrene were adjusted to develop SSLs for the remaining carcinogenic polycyclic aromatic hydrocarbons (cPAHs) (i.e., benzo[a]anthracene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenzo[a,h]anthracene, and indeno[1,2,3-c,d]pyrene). A footnote should be added to Table 2-1 indicating how the SSLs for cPAHs were derived and showing the corresponding reference(s). In addition, Section 2.3 should be modified to include a discussion of the use of toxicity equivalence factors (TEFs) for benzo(a)pyrene in the development of SSLs for the remaining cPAHs.

12) A review of Table 2-1 indicates that a soil inhalation SSL was calculated for 2-butanone. It should be noted that the chemical-specific parameters needed to calculate the inhalation SSL for 2-butanone are not provided by USEPA's SSL Guidance. Therefore, Section 2.3 should be modified to identify the chemical-specific parameters (e.g., Di, H, Dw, Kd, Koc) used to calculate the soil inhalation SSL for this chemical.

13) The text does not identify the screening values used to evaluate lead at the site. In addition, Table 2-1 fails to specify the nature of the screening levels used for this chemical. The text and Table 2-1 should be modified to indicate that maximum lead concentrations in soil and sediment were compared to the residential SSL of 400 mg/kg (USEPA Soil Screening Guidance: User's Guide. Office of Solid Waste and Emergency Response [OSWER]. EPA/540/R-96/018. April, 1996) or the Missouri Department of Health's clean up level of 238 mg/kg. The text and tables should also be modified to indicate that lead concentrations in groundwater were compared to USEPA's action level of 15 ug/L for lead in residential and public drinking water (USEPA Drinking Water Regulations and Health Advisories. Office of Water. October, 1996).

Section 2.3, Paragraph 3, Page 2-4

14) The text states, "For chemicals without MCLs, risk-based screening levels were used as the basis for [groundwater] comparison. Risk-based levels were determined by using SSL ingestion equations with an ingestion rate of 1 liter/day for a child and 2 liters/day for an adult." The text fails to clearly identify the methodology, exposure assumptions, and toxicity criteria used in the calculation of risk-based groundwater screening levels. The text should be modified to reference the specific equations provided by the SSL Guidance used to calculate these values, and to indicate whether the default exposure parameters provided by the Guidance were used in these calculations. A table should be included showing the value and source of toxicity criteria used in these calculations.

Section 2.3, Paragraph 4, Page 2-4 and Table 2-1

15) Paragraph 4 indicates that groundwater screening values for volatilization were developed using the SSL partitioning equation to groundwater provided in the SSL Guidance. The text should be modified to reference the specific equation number in the SSL Guidance used to calculate groundwater inhalation SSLs. In addition, Section 2.3 should be modified to include a table identifying the values and sources of the oral toxicity criteria used to calculate the groundwater inhalation SSLs used in the risk assessment.

As discussed for soil SSLs in Comment 3, the groundwater inhalation SSLs should be adjusted to account for potential additive noncarinogenic health effects at the site.

16) Table 2-1 provides groundwater inhalation SSLs of 350 ug/L for benzene and 1,600 ug/L for tetrachloroethene. These values can not be verified using Equation 10 provided by USEPA,

1996a, and the corresponding soil inhalation SSLs provided on Table 2-1. The calculation of these groundwater inhalation SSLs should be verified, and Table 2-1 should be modified as appropriate.

Section 2.3, Tables 2-2 through 2-36

17) Tables 2-2 through 2-36 should be revised to show the range of nondetect values (i.e., sample quantitation limits {SQLs}) as well as the detection range as recommended in USEPA's Risk Assessment Guidance for Superfund (RAGS), Part D Guidance. This information is critical to risk management decision-making because it allows the overall quality and the protectiveness of the detection limits to be assessed.

18) The 95 UCL should not be calculated for data sets of less than 10 sampling points as noted EPA's 1992 OSWER directive 9285.7-081. In such cases, the maximum detection should be used as the exposure point concentration for risk evaluations. Tables 2-11, 2-18, 2-22, 2-24, 2-29, and 2-31 as well as all populations and pathways using the 95 UCL data in these tables should be revised to conform to this policy.

Section 3.0 Toxicity Assessment

Section 3.1, Paragraph 5, Page 3-2

19) Paragraph 5 indicates that gastrointestinal absorption efficiency values of 80 percent for volatile organic compounds (VOCs) and arsenic, 50 percent for semivolatiles (SVOCs), and 5 percent for inorganics (other than arsenic) were used to modify oral RfD values in order to assess the dermal route of exposure in the risk assessment. The text further states, "These absorption factors were selected based on USEPA Region VII policy currently under development (Pers. Com., 1998)." The text does not indicate the nature or status of this policy decision, and the reference section of the risk assessment does not provide additional information. The risk assessment should be modified to include documentation (e.g., a record of communication or copy of a draft USEPA Region VII risk assessment guidance document), supporting the use of the selected absorption factors. Further, USEPA Region IX has recently provided chemical-specific oral absorption factors for many contaminants in "A Risk Assessment Guidance for Superfund Volume I: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment, Interim Guidance", EPA/540/R-99/005, 1999 (1999 Dermal Guidance). In addition, general absorption factors for various classes of chemicals (i.e., VOCs, SVOCs, etc.) are provided by the USEPA Region III's Technical Guidance Manual "Assessing Dermal Exposure from Soil", EPA/903-K-95-003 (1995 Dermal Guidance). The default, general absorption values found in this document are 0.01 for inorganics, 0.1 for SVOCs, and 0.03 for VOCs. The risk assessment should be revised to assess dermal exposures according to these two EPA documents unless specific, defensible documentation can be provided for the values used in

the risk assessment.

Section 3.2, Paragraph 4, Page 3-3

20) See Comment 19.

Section 4.0 Exposure Assessment

Section 4.1, Paragraph 11, Page 4-3

21) The text states, "Groundwater is not currently used for any purpose at the facility. Potable water is supplied by the city of Kansas City, Missouri. The anticipated future uses for groundwater beneath the facility are expected to remain unchanged." Section 4.1 does not provide sufficient documentation supporting the assumption that site groundwater will not be used for drinking water or other purposes in the future. Section 4.1 should be modified to include, or refer to, portions of the discussion of regional and site hydrology provided in Sections 2.6.1 and 2.6.2 of the RFI. If site groundwater is not likely to be used as drinking water based on the quality of the groundwater, or based on industrial controls or deed restrictions present at the site, then this should be clearly stated in the risk assessment. Similar rationale should be provided to support the assumption that site groundwater will not be used for industrial processes in the future. If such documentation can not be provided, then future site worker exposures to groundwater via ingestion or dermal contact and inhalation (e.g., while washing hands) should be considered for evaluation in the risk assessment.

In order to ensure the protection of potential off-site residential or industrial receptors, the risk assessment should specifically identify potable wells and industrial groundwater supply wells in the vicinity of the site and should discuss the hydraulic interconnection between on-site and off-site groundwater sources.

Sections 4.2.1.1 through 4.2.1.15, Pages 4-3 through 4-11

22) Sections 4.2.1.1 through 4.2.1.15 identify and discuss potentially exposed populations at each of the SWMUs or AOCs evaluated in the risk assessment. Within each section, the discussion of potentially exposed populations focuses on exposures to various site workers (including occasional mowers, truck and lift operators, weed control personnel, and shipping and maintenance personnel) and utility workers. Utility workers are referred to as "temporary excavation workers" in the risk assessment. Sections 4.2.1.1 through 4.2.1.15 fail to adequately address potential exposures for the following receptors at each site:

a) Future full-time site workers, assuming further industrial development at each SWMU and AOC

b) Future site construction workers, assuming further industrial development at each SWMU and AOC
c) Trespassers.

Specific issues pertaining to each of these receptors are discussed below.

Future Industrial Site Workers. The risk assessment identifies specific areas where full-time workers are likely to be present in the future based on current and projected future land-use (e.g., SWMUs 2, 4, 8, 10, 11, and 27). The risk assessment should conservatively assume that further industrial development could occur throughout the Armco facility in the future. Based on this assumption, Sections 4.2.1.1 through 4.2.1.15 should be modified to discuss full-time industrial site workers as potential receptors at each SWMU and AOC.

Future Site Construction Workers. The risk assessment does not include the evaluation of site construction workers. However, Sections 4.2.1.5, 4.2.1.6, 4.2.1.7, 4.2.1.9, and 4.2.1.13 indicate that construction/excavation activities are likely to occur at the site to support industrial expansion, building alterations, and development of the South Riverfront Expressway. In addition, Sections 4.2.2.1, 4.2.1.2, 4.2.1.3, and 4.2.1.8 suggest that future construction/excavation activities could occur to support the integration of SWMUs 2, 4, 6, and 13 "into other future industrial use scenarios." These statements suggest that future site construction workers, having potential exposures greater than those of current utility workers, should be evaluated as potential receptors at the site. Assuming that each SWMU or AOC at the Armco facility could be further developed for industrial purposes in the future, Sections 4.2.1.1 through 4.2.1.15 should be modified to identify and discuss full-time construction workers as potential receptors under future land-use conditions at each SWMU and AOC.

Trespassers. A review of the facility map (Figure 1-1) shows that AOC 8 and SMWUs 2, 4, and 12 are located near Rock Creek, and several SMWUs are located along the banks of the Blue River where trespassers may access the site. Sections 4.2.1.1 through 4.2.1.15 should be modified to more thoroughly identify and discuss trespassers as potential receptors at the site under current and future land-use conditions. Trespassers are a particularly likely exposure population along the southern boundary (i.e., AOC 8 and SWMU 12) of the eastern portion of the site where adjacent residents and school children to the south have unimpeded access to the site. Historical trespassing is documented in Section 4.2.1.7 of the report where it states that hunters have been noted in SWMU 12. Consequently, unless detailed, defensible and strong evidence can be provided to the contrary, trespassers should be evaluated for the SWMUs and AOCs in the eastern portion. This is of particular importance since this area is vacant much of the year and the exposure duration of trespassers is likely to exceed that of limited worker scenarios.

Section 4.2.2, Paragraph 1, Page 4-11

23) The text indicates that exposures to full-time workers and temporary excavation workers were quantitatively evaluated at each SWMU or AOC in the risk assessment. Assuming that each SWMU or AOC at the Armco facility could be further developed for industrial purposes in the future, Section 4.2.2 should be modified to indicate that exposures to site construction workers will be quantitatively evaluated at each SWMU or AOC in the risk assessment. In addition, based on a thorough evaluation of potential trespasser exposures at each site (see Comment 22), Section 4.2.2 should be revised to include an appropriate, quantitative evaluation of potential exposures to trespassers.

Section 4.3, Tables 4-1 through 4-15

24) Section 4.3 and Tables 4-1 through 4-15 present the exposure populations and pathways that are evaluated in the risk assessment without specifying a time frame for these exposures. The text and tables should be revised to delineate which receptors evaluated are currently present and which may be present in the future. In addition, the text and tables present exposure pathways for full-time workers and temporary excavation workers without considering potential future construction workers. The risk assessment text and tables should be modified to identify potentially complete exposure pathways for site construction workers conducting construction/excavation activities at each SWMU and AOC. Construction worker exposures to surface soil, subsurface soil, and groundwater at depths up to 10 feet bgs should be included for evaluation in the risk assessment, unless strong rationale can be provided to eliminate specific pathways. In addition, the risk assessment text and tables should be modified to identify complete exposure pathways for trespassers at any SWMUs or AOCs where trespassers may be identified as potential receptors at the site (see comment 22).

Section 4.3.1.11, Paragraph 1, Page 4-15

25) The text indicates that full-time worker exposures to contaminants of potential concern (COPCs) in surface soil at SWMU 25 were not evaluated in the risk assessment because the site is completely paved. Assuming that future industrial development of SWMU 25 could occur and the pavement at the site could be removed, future full-time worker exposures to COPCs in surface soil at SWMU 25 should be quantitatively evaluated in the risk assessment. The text and tables should be revised accordingly.

Section 4.3.1.12, Paragraph 1, Page 4-15

26) The text indicates that full-time worker exposures to lead (i.e., the single COPC) in surface soil at SWMU 27 were not evaluated in the risk assessment because the site is completely paved. Assuming that future industrial development of SWMU 27 could occur and the pavement at the site could be removed, future full-time worker exposures to lead at SWMU 25 should be

quantitatively evaluated in the risk assessment. The text and all associated tables should be revised accordingly. An appropriate evaluation of exposures to lead at SWMU 27 in Section 5.3 of the risk assessment should be included.

Section 4.4.1 and Tables 4-16 through 4-21

27) Section 4.4.1 and Tables 4-16 through 4-21 present the exposure variable values and equations used to estimate exposure doses for full-time workers and temporary excavation workers. The risk assessment text and tables should be modified to include the variable values and equations used to estimate exposure doses for site construction workers at each SWMU or AOC. The values and equations used to evaluate exposures to site construction workers should be identical to the values and equations used to evaluate exposures to temporary excavation workers with the exception of the selected exposure duration (ED). It should be assumed that excavation workers could be exposed at the Armco facility 250 days per year (ED = 250 days/year), based on USEPA, 1991.

In addition, the text and tables should be modified to include the variable values and equations used to estimate exposure doses for trespassers at SWMUs or AOCs in the eastern portion where trespassers may be identified as potential receptors at the site (see comment 22).

Section 4.4.2.3, Paragraph 1, Page 4-27

28) Section 4.4.2.3 discusses the use of a gastrointestinal adjustment factor (AAF) in assessing exposures to chemicals in soil via incidental ingestion. The text indicates that the dose estimate associated with incidental ingestion of PAHs in soil was adjusted by a factor of 0.29, based on data provided in Magee et al, 1996. The application of an AAF in estimating the intake of PAHs in soils does not provide a conservative evaluation of potential risks associated with the ingestion of chemicals in soil and is not consistent with USEPA's 1999 Dermal Guidance (see comment 19). The text and associated tables should be modified to eliminate the use of the AAF. In the uncertainty section of the risk assessment, include a discussion of the AAF and provide a semi-quantitative evaluation indicating the potential impact of the AAF on soil risk estimates.

Section 4.4.2.4, Paragraph 2, Page 4-28

29) The text indicates that an absorption factor of 0.014 was selected to evaluate dermal exposures to benzo(a)pyrene in soil. This absorption factor does not represent an adequately conservative value for use in the risk assessment. In accordance with 1999 USEPA guidance, a value of 0.13 should be used (see comment 19).

30) The text states, "Absorption values of 0.10 for the remaining SVOCs and 0.01 for VOCs and inorganic chemicals were used as a reflection of USEPA VII policy currently under development

(Pers. Com., 1998)." The text does not indicate the nature or status of this policy decision, and the reference section of the risk assessment provides no additional information. The risk assessment should be modified to include documentation (e.g., a record of communication or copy of a draft USEPA Region VII risk assessment guidance document) supporting the use of the selected absorption factors. If adequate supporting documentation can not be provided, the following modifications should be made to the risk assessment:

a) Chemical-specific absorption values found in USEPA's 1999 Dermal Guidance should be used (see comment 19).

b) The text should be modified to indicate a default absorption value of 0.01 was conservatively selected for all remaining inorganic chemicals, as provided in USEPA's 1995 Dermal Guidance (see comment 19).

c) The text should be modified to indicate that a default absorption value of 0.10 was conservatively selected for all remaining SVOCs, as provided in USEPA's 1995 Dermal Guidance (see comment 19).

d) The text should be modified to indicate that a default absorption value of 0.03 was conservatively selected for all remaining VOCs, as provided in USEPA's 1995 Dermal Guidance (see comment 19).

e) The text and all associated tables should be modified to indicate an absorption value of 0.032 was conservatively selected for arsenic based on chemical-specific data for arsenic provided in Wester et al, 1993. [Wester, R.C., H.I. Maibach, et al. 1993. In vivo and in vitro percutaneous absorption and skin decontamination of arsenic from water and soil. Fundamental and Applied Toxicology. Vol. 20, No. 3, pp. 336 – 340.] This value for arsenic is also used in USEPA's aforementioned 1999 Dermal Guidance.

Section 5.0 Risk Characterization

Section 5.1.1, Paragraph 2, Page 5-1

31) Section 5.1.1 indicates that total pathway hazard indices of one or less are unlikely to be associated with adverse health effects. Section 5.1.1 fails to discuss the standard treatment of pathway hazard indices greater than one in risk assessments. Although all of the pathway hazard indices calculated for the Armco facility were less than one, it is important for the risk assessment to acknowledge and discuss the additive health effects associated with noncarcinogenic chemicals. The text should indicate that where a pathway hazard index is greater than one the associated chemicals are subdivided into categories based on similar target

organs or critical effects, in accordance with USEPA's 1998 RAGS, part D and 1989 RAGS guidances. Hazards indices are then recalculated for each category to identify whether adverse effects to specific target organs or endpoints might occur.

Section 5.2 and Tables 5-1 through 5-35

32) Section 5.2 presents the hazard and risk estimates for full-time workers and temporary excavation workers evaluated in the risk assessment. This section should be modified, and tables included, to address the evaluation of site construction workers and selected trespassers (see comment 22).

33) Section 5.2 includes 35 tables showing cancer risk and hazard index estimates, but does not include a summary table of risk assessment results. In order to facilitate the review of the risk assessment during the risk management process, Section 5.2 should be modified to include a summary table showing total risks and hazard estimates for each receptor associated with all relevant exposure media and pathways evaluated in each SWMU or AOC. For receptor populations and / or pathways with total cancer risks greater than or equal to $1x10^{-6}$ or total HIs greater than or equal to one, the predominant chemicals contributing to the risk or hazard should be identified.

34) Section 5.2 does not include an evaluation of potential cumulative risks across multiple SWMUs or AOCs. In accordance with USEPA 1989 RAGS guidance, the risk assessment should be revised to qualitatively and potentially quantitatively address the cumulative risks associated with plausible exposures in more than one area of the Armco facility. Appropriate multiple-area risk estimates should be provided in a separate summary table for appropriate receptor populations (see comment 33).

Section 5.2.2.1, Paragraph 1, Page 5-4 and Table 5-5

35) Table 5-5 presents an incorrect RfD for benzene of 2E+03 mg/kg/day. Modify Table 5-5 to include the appropriate RfD for benzene of 2E-3 mg/kg/day. Modify the table and associated text in Section 5.2.2.1 to reflect the revised total HI.

Section 5.2.2.2, Paragraph 1, Page 5-4 and Table 5-7

36) Table 5-7 presents an incorrect RfD for benzene of 2E+03 mg/kg/day. Modify Table 5-5 to include the appropriate RfD for benzene of 2E-3 mg/kg/day. Modify the table and associated text in Section 5.2.2.2 to reflect the revised total HI.

Section 5.3, Paragraphs 1 and 2, Page 5-12, and Table 5-36

37) Paragraphs 1 and 2 indicate that nonresidential exposures to lead at the Armco facility were evaluated in accordance with USEPA's 1996 TRW Lead Guidance. However, a review of Table 5-36 indicates that the mean daily soil ingestion rate (IRsd) and exposure frequency (EF) used to evaluate worker exposures to lead in the risk assessment were not selected in accordance with the recommendations of the TRW. Specifically, USEPA, 1996 recommends using an IRsd of 0.05 gram/day and an EF of 219 days/year in evaluating worker exposures, while the risk assessment assumes an IRsd of 0.005 gram/day and an EF of 250 days/year. According to USEPA, 1996, page 5, "these defaults should not be casually replaced with other values unless the alternatives are supported by high quality site-specific data to which appropriate statistical analyses have been applied and that have undergone thorough scientific review." The rationale for each default value is provided in Appendix A to the USEPA, 1996 guidance.

Site-specific conditions at the Armco facility do not warrant modification of the default parameters recommended by USEPA's Lead Guidance. Therefore, in order to provide a conservative evaluation of nonresidential exposures to lead in the risk assessment, Section 5.3 should be revised to include an evaluation of lead using the methodology recommended by USEPA's Lead Guidance, including the default IRsd of 0.05 gram/day and default EF of 219 days/year. The uncertainties associated with the use of USEPA recommended default IR and EF values should be qualitatively and semi-quantitatively evaluated in the uncertainty section of the risk assessment.

Section 5.3, Paragraphs 3 and 10, Pages 5-12 through 5-14, and Table 5-37

38) Paragraph 3 indicates that in addition to evaluating nonresidential exposures to lead using USEPA's 1996 TRW guidance, the risk assessment also evaluated "a more likely site-specific scenario" involving a generic non-pregnant worker. According to Paragraph 10 and Table 5-37, exposures to a generic non-pregnant worker were evaluated using an assumed IRsd of 0.005 gram/day. Assuming that the Armco facility could be further developed for industrial purposes in the future, an IRsd of 0.005 gram/day does not provide a conservative evaluation of potential site worker exposures at the Armco facility. As discussed in USEPA's TRW guidance, Appendix A, the Superfund Program considers an IRsd of 0.05 gram/day to be a plausible point estimate of the central tendency for daily soil intake from all occupational sources, including soil in indoor dust, resulting from non-contact intensive activities. This guidance further notes that more intensive activities, such as construction/excavation work, may result in higher ingestion rate values.

Site-specific conditions at the Armco facility do not support the assumption that an IRsd of 0.005 gram/day represents "a more likely site-specific scenario." The evaluation of the generic non-pregnant worker provided in the risk assessment should be modified to incorporate an IRsd of 0.05 gram/day instead of 0.005 gram/day. The uncertainties associated with the use of the USEPA recommended default IRsd value should be qualitatively and semi-quantitatively

evaluated in the uncertainty section of the risk assessment.

Section 5.3, Paragraph 1, Page 5-13

39) Occupational Safety and Health Administration (OSHA) screening values should not be used as the action levels for worker exposures in risk assessment. These values are only applicable for lead industry workers who are under a continuous blood lead monitoring program. The only applicable blood lead standard for USEPA risk assessments is the 10ug/dl value for child or fetal exposures and, consequently, the text and tables should be revised accordingly.

Section 5.3, Table 5-38

40) Table 5-38 indicates that the potential risks associated with exposures to lead at the Armco facility were evaluated based on exposures to the lower of the 95% UCL concentration and the maximum detected concentration of lead within each SWMU, AOC, or data grouping. Given the high concentrations of lead detected throughout the site, the risk assessment should be modified to further evaluate and characterize the potential presence of "hot spot" lead contamination at the site. For example, the maximum lead concentration detected at AOC 8 was 55,200 mg/kg. This value is more than 30 times greater than the highest risk-based remediation goal of 1,750 mg/kg estimated by USEPA, 1996 to be protective of nonresidential receptors using default exposure parameters. The risk assessment should be modified to include a more thorough qualitative and semi-quantitative review of the available analytical data for lead at each SWMU or AOC where the maximum detected lead concentration exceeded the residential SSL of 400 mg/kg. The risk assessment should assess the quality of the available analytical data for lead at each SWMU or AOC, identify any potential data gaps, and discuss the distribution of lead and the potential for hot-spot contamination.

41) As shown on Table 5-38, the risk assessment did not evaluate exposures to lead in surface soil at SWMUs 25 and 27, presumably because these SWMUs are covered with pavement. Lead was detected at concentrations above the 400 mg/kg SSL for lead at both sites. Assuming that construction activities could occur under future industrial land-use conditions at SWMUs 25 and 27, the risk assessment should be modified to include a quantitative evaluation of exposure to lead in subsurface soil at both sites.

Section 5.3.10, Paragraph 1, Page 5-17

42) The discussion of blood lead levels of generic workers being below OSHA limits is not applicable and should be deleted (see comment 39). Further, due to AOC 8's proximity and accessibility to the public, a pregnant trespasser exposure to lead should be evaluated. The lead exposures in AOC 8 currently evaluated in the report (without consideration of trespassers) are in excess of the target health levels and should be considered during risk management of this AOC.

Section 5.4.1, Paragraph 3, Page 5-18

43) Section 5.4.1 addresses the uncertainty associated with chemical identification and quantification in the risk assessment. This discussion should be modified to identify non-detect chemicals for which detection limits exceeded the screening levels used in the risk assessment and the explanation for these nonconservative detection limits. Further, if detection limits were too high to protect human health and/or the environment, text should be added to discuss the potential for underestimated risk and hazards.

Section 5.4.3, Paragraph 3, Page 5-20

44) The text states, "A value for soil ingestion of 5 mg/day, derived from more recent studies and believed to be more accurate than the previous default rate, was used in the adult lead model." As discussed in comment 37, Section 5.3 of the risk assessment should be modified to use the USEPA default soil ingestion of 50 mg/day in the adult lead model. The text in Section 5.4.3 should be revised accordingly. The use of other assumed IRsd values (e.g., 5 mg/day) should be qualitatively and semi-quantitatively evaluated in the uncertainty section.

Section 6.0 Summary

Section 6.0, Paragraph 1, Page 6-1

45) The text states, "COPCs were selected based on screening against SSLs and MCLs." To facilitate the review of the risk assessment during the risk management process, Section 6.0 should be modified to specify the SSLs selected for use in the risk assessment and the primary COPCs selected in each media. For example, it should be noted that polynuclear aromatic hydrocarbons (PAHs), arsenic, cadmium, and lead were the predominant COPCs in the soil at several of the SWMUs and AOCs. A similar discussion should be provided for groundwater and sediment.

Section 6.0, Paragraph 3, Page 6-1

46) The text indicates that all excess lifetime cancer risk estimates were within or below USEPA's target risk range and all hazard indices were below one. To facilitate the review of the risk assessment during the risk management process, Section 6.0 should be modified to identify the exposure pathways and risk-driving chemicals associated with the highest estimated risks and hazards at each SWMU and AOC.

III. ECOLOGICAL RISK ASSESSMENT, APPENDIX Y

A. General Comments

47) The ecological risk assessment does not document the evaluation/elimination of many ecotoxicological chemicals (i.e., copper, mercury, etc.) and begins the assessment in each SWMU with an abbreviated chemical list presumably of only those chemicals which were detected. This does not follow the latest EPA guidance presented in the Ecological Guidance for Superfund (ERAGS), 1997. The entire list of analytes with their corresponding detection limits (i.e., SQLs) should be provided. The report should then compare these detection limits to the appropriate ecological benchmarks. Those chemicals whose detection limits are greater than their corresponding benchmarks should be retained as chemicals of potential ecological concern (COPEC) and evaluated in the risk assessment.

48) The assessment of each SWMU should contain a thorough toxicological profile for each COPEC identified, as required by ERAGS. The report does discuss some of the toxicological characteristics of a few COPECs, but this is done with the focus of dismissing the potential risk generated by these chemicals. The toxicological profile should document the environmental fate and transport of each COPEC in various on-site media, as well as the empirically derived toxicological effects of each COPEC on the site-relevant species. The published studies that provide this chemical information should then be referenced in the report. Examples of toxicological profiles can be found in Appendix A of ERAGS.

49) The assessment of each SWMU should include a site conceptual exposure model (SCEM) detailing all of the potential exposure pathways and ecological receptors on and off site. The lack of a SCEM for each SWMU accounts for many potential exposure pathways that have not been evaluated. For example, the report does not consider transport of soil contaminants to off-site surface water bodies through overland flow after precipitation events. Such transport would potentially effect aquatic and sedimentary receptors (i.e., fish and benthic macroinvertebrates). Further, the transport of soil contaminants to surface water by infiltration to groundwater and then groundwater flow into surface water has also not been considered. These and other potential effects of on-site contamination on off-site habitats should be evaluated.

50) ERAGS requires the completion of a "checklist for ecological assessment" during initial ecological field visits. The checklist is a field-screening tool for preliminary site evaluation that provides information for the subsequent generation of a SCEM in the ecological risk assessment. It also may serve as a starting point for the collection of biological data, if appropriate. Consequently, this checklist provides a powerful planning tool for ecological assessment if the specific information the checklist requires is gathered during the site visit. The Armco assessment does contain a checklist (Attachment Y-1), but this checklist does not fulfill the intent of ERAGS. The included checklist attempts to characterize the whole 1,100-acre Armco property consisting of numerous habitats (i.e., old field, riverine, industrial, etc.) as one unit and, therefore, lacks essential habitat details in and around each evaluated SWMU (particularly,

SWMU 4, SWMU 12, and AOC 8). The omissions include contaminant transport pathways for each evaluated SWMU, specific descriptions of habitat features in and around each SWMU (i.e., distance to nearest surface water bodies and wetlands, depth to groundwater, etc.), SWMU-specific receptors, and potential routes of off-site contaminant migration for each SWMU. This lack of specific information is carried through the report and results in an incomplete evaluation of the potential ecological risk in and around each SWMU. Separate checklists with adequate levels of detail should be prepared for each SWMU or AOC from the available information (i.e., report documents from numerous site visits made). This information will then serve as a repository for the generation of SWMU-specific SCEMs and the eventual determination of ecological risk at each SWMU.

B. Specific Comments

Section 2.0 Ecological Evaluation Methodology

Section 2.2, Page 2-1, Paragraph 1

51) The assessment states that neither USFWS nor MDOC reported any known threatened or endangered species residing in the area. The report needs to add text defining what "in the area" means. Further, the report should mention that both agencies noted the presence of the pallid sturgeon (Scaphirhynchus albus) in the Missouri River and the likely intermittent presence of the bald eagle (Haliaeetus leucocephalus) along Blue and Missouri Rivers. The potential impact, or lack thereof, of site contaminants on these two species should be discussed.

Section 2.2.1, Page 2-2, Paragraph 1

52) The discussion of the potential exposure of flora and fauna to surface soil contaminants omits consideration of food chain exposures. An example of this type of exposure would be the bioconcentration of soil contaminants in annelids and their consumption by avian species. The bioaccumulation of soil contaminants through the food chain should be discussed and potentially quantitatively evaluated. This is particularly important for this site since the COPEC list includes contaminants known to bioaccumulate (i.e., lead and PAHs).

Section 2.2, Pages 2-1 through 2-2

53) This section fails to discuss the transport of contaminants in the groundwater and soil (overland flow) to downgradient wetlands and/or surface water bodies. The impact of this contaminant transport on the flora and fauna of the wetlands and Rock Creek should then be evaluated. Unless these transport mechanisms can be ruled out, available standard benchmarks for sediment and surface water should be compared to primary results from these media (in downgradient wetlands and water bodies). Alternatively, sediment and surface water benchmarks

could be directly compared to current groundwater and surface soil concentrations.

Section 2.3.1.1.1, Page 2-4, Paragraph 2

54) The evaluation of wildlife exposure to on-site contaminants should consider bioaccumulation of contaminants through the food chain to higher trophic levels (see comment 52).

Section 2.3.1.2, Page 2-5, Paragraph 1

55) The data sets used to calculate the various receptor exposure point concentrations (i.e., either maximum or 95 UCL) should be included in the ecological assessment for each of the SWMUs and AOCs. These data sets should include columns identifying the exposure point concentrations chosen for each media. Text should then be added referring the reader to the aforementioned raw data sets.

Section 2.3.1.1, Page 2-4, Paragraph 2

56) The report states that all no observed adverse effects levels (NOAELs) used were weight-normalized without identifying the indicator species for which the normalization calculation was performed. Specific indicator species should be identified for each major type of wildlife (i.e., avian, mammalian, etc.) evaluated in each SWMU.

Section 2.3.2.2, Page 2-8, Paragraph 1

57) The report states that no chemicals identified during this evaluation are known to biomagnify. This is simply not the case. For example, the PAHs identified in SWMU 4 can accumulate in invertebrates as demonstrated by Neff. Neff, in a 1985 book entitiled "Fundamentals of Aquatic Toxicology," lists bioaccumulation factors for 7 PAHs ranging from 131 to 10,000. Thus animals that feed on contaminated invertebrate prey (e.g., birds on annelids) may be exposed to increased levels of PAHs and should be considered potential ecological receptors. In addition, lead (SWMU 12 and AOC 8) has been shown to have high bioconcentration factors. Consequently, the report should discuss and potentially assess the risk of food chain exposures to primary and secondary consumers.

Section 3.0 Ecological Site Conditions Characterization

Section 3.0, Page 3-1, Paragraph 1

58) This section combines all of the onsite SWMUs and AOCs that were not evaluated for ecological risk and states that they did not have sustainable habitat or had incomplete or

insignificant exposure pathways. This is not an adequate level of detail to justify the elimination of entire sets of SWMUs. A justification should be added for each SWMU and AOC not evaluated, describing each area specifically and stating why each was eliminated from ecological risk evaluation. This is particularly important for those SWMUs in the less disturbed, eastern portion of the facility that were not evaluated (SWMUs 5 and 22). The report needs to clearly document why these SWMUs in the eastern portion were not evaluated while other SWMUs (SWMUs 4 and 12 and AOC 8) in this area were.

Section 4.0 Ecological Risk Characterization

Section 4.1, Page 4-2, Paragraph 2

59) Although the assessment acknowledges a potential ecological risk to birds and mammals at SWMU 4, it rhetorically dismisses this risk by stating that no adverse effects to these species were obvious during a field visit. It is not clear what adverse effects, other than the most acute and severe phenotypic changes, would be obvious during a short field visit. The finding of no ecological harm should not be based on severe physical malformations in individual species, but on much more comprehensive measures of community fitness such as species diversity, richness, and evenness. Site-specific studies can also be conducted to assess the fitness of an individual species within a community (e.g., average onsite clutch size compared to national norms, etc.). The report should discuss specifically what site data or observations justify the position that ecological receptors are not potentially at risk even though risk-based chemical benchmarks have been exceeded.

Section 4.0, Table 4-5

60) The benchmark for cadmium exposure to white-tailed deer (0.271 mg/kg/day) is not listed; however, the table does list the white-tailed deer benchmark for lead exposure. The risk of cadmium exposure to white-tailed deer should be evaluated.

Section 4.0, Table 4-6

61) This table assesses the site-specific ecological risk to a variety of fauna using empirically established lowest observed adverse effects levels (LOAELs) as chemical exposure benchmarks. This does not follow current EPA guidance for an ecological assessment and is not adequately conservative. EPA's ERAGS recommends that NOAELs be used for screening level assessments (e.g., those for which on-site biota sampling and/or toxicity testing is not conducted). The use of LOAELs in Table 4-6 is noteworthy because LOAELs are generally an order of magnitude above NOAELs, and the current calculated hazard quotients are generally greater than 0.1. Consequently, if NOAELs instead LOAELs are used in Table 4-6, the resultant hazard quotients for most of the wildlife evaluated will exceed 1.0.

Section 4.0, Table 4-15

62) This table uses nonconservative LOAELs instead of recommended NOAELs to evaluate wildlife exposures in SWMU 12 (see comment 61).

Section 4.2, Page 4-4, Paragraph 1

63) This paragraph states that the habitat of SWMU 12 is of "low quality" and, therefore, the ecological risks can be dismissed. However, adequate justification for this judgement is not provided. Text should be added to justify this description (e.g., habitat is of low quality because it is disturbed by regular mowing and other human activities).

Section 4.3, Page 4-4, Paragraph 3

64) The text states that the lead shot in AOC 8 is buried under 3 to 4 inches of silt and is, therefore, unavailable to avian species that might ingest them. The report should discuss whether the 3 to 4 inches of silt covering is uniform across the AOC and whether it is protected from wind and water erosion by vegetative growth. If vegetative growth is absent, then erosion could quickly expose shot pellets, making them available as grit for avian species. Further, the report does not discuss the potential effect on off-site surface water receptors by infiltration through soil column to groundwater and then groundwater transport to surface water bodies.

Section 4.3, Page 4-5, Paragraph 2

65) The report notes that habitat of "higher quality" exists near AOC 8. Text should be added discussing the general attributes of this "better habitat," its proximity to AOC 8, and the potential impact on this off-site habitat of contaminant migration from AOC 8 via overland and groundwater flow.

Attachment Y-1 Checklist for Ecological Assessment

Attachment Y-1, Section I, Question 4

66) The ecological site visit checklist documents multiple site visits, but does not give the dates or trip reports of previous site visits. The dates and trip report information should be included on new checklists for each evaluated SWMU or AOC.

Attachment Y-1, Section I, Question 14

67) The checklist indicates that the direction of surface runoff was not apparent during field observation. This is a critical piece of information in the determination of contaminant transport

pathways on and offsite. This information should be obvious even to a casual observer in a discreet area, but because the checklist attempts to cover the entire 1,100-acre property comprised of numerous topographical highs and lows, it is impossible to determine. Again, this property-wide approach fails to provide the data required by ERAGS. If a separate checklist were prepared and included for each evaluated SWMU or AOC, then this type of specific information would be apparent.

Attachment Y-1, Section I, Question 16

68) The checklist indicates that a waterbody is within 100 to 500 feet of the site. It is clear that this requires a specific on-site reference point (i.e., 100 to 500 feet from which of the numerous on-site SWMUs or AOCs). The information requested by the checklist is intended to provide specific data on a discreet habitat that will lead to the generation of a SCEM for a specific area (i.e., SWMU or AOC).

Attachment Y-1, Section III

69) The checklist indicates that there are wetlands present somewhere on the approximately 2 square mile property, but again fails to provide a specific reference point for these wetlands or specific information on the impact of surrounding SWMUs or AOCs.

IV. OTHER SECTIONS OF THE RFI

A. General Comments

70) The descriptions of each SWMU and AOC in Chapters 5 through 24 of the RFI do not provide the entire data set for review. For example, the only metal included in the data set for SWMU 2 is lead. The entire 6010 list of metals analyzed should be given so that the RFI's data evaluation methods can be reviewed for adequacy and appropriateness. The other SWMUs and AOCs also only contain abbreviated lists of VOCs, SVOCs, and metals instead of the full list of analytes for these classes and the chemical-specific detection limits (i.e., SQLs, MDLs, etc.). This will allow the risk manager to evaluate whether detection limits used for each analyte were adequate to protect human health and the environment.

B. Specific Comments

Volume I, Section 2.1.1, Page 2-1, Paragraph 1

71) The RFI should state the approximate distance to the residential developments located southeast and west of the facility.

Volume I, Section 2.7, Page 2-21, Paragraph 2

72) The RFI states that the emergent and forested wetlands in the eastern portion of the site are of little ecological value because they are disturbed. Text needs to be added detailing the disruption of these habitats (i.e., stressed vegetation, etc.). In addition, a discussion of area just offsite in this vicinity (i.e., other industries) and how this impacts these habitats should be added.

V. SUMMARY

Several non-conservative elements are incorporated into the current Human Health Risk Assessment for the Armco facility which potentially render the assessment inadequately protective of human health. These elements include:

1) Inappropriate use of USEPA's Soil Screening Guidance when screening out chemicals with the same target organ. This guidance specifically states that for chemicals with the same target organ the screening value of each additive chemical should be lowered in order that the cumulative effect on the organ remains protective of human health. This additivity was not evaluated in the risk assessment; potentially screening-out groups of chemicals whose cumulative effect may be deleterious to human health.

2) The exclusion of potential media, receptors, and exposure pathways, which if appropriately assessed, may add significant risk to human health. The current HHRA does not quantify exposure to future construction workers even though the likelihood of future development is specifically addressed in the text. The HHRA does not quantify exposure to trespassers despite the facts that access to the eastern portion of the site is unimpeded, residents live adjacent to the eastern portion, and historical trespassing has been documented (see comment 22). Finally, the HHRA, without providing adequate justification, fails to consider future exposures to groundwater. Even if these exposures were not residential or potable in nature, significant risk could be posed by industrial groundwater use through dermal contact and inhalation.

3) The evaluation of lead exposures in the various SWMU's and AOC's is not adequately conservative due to the use of low, nonstandard intake rates and inappropriate blood-lead standards. The HHRA, without detailed site-specific justification, utilizes a soil intake rate an order of magnitude less than standard default to assess lead exposures. The use of this nonstandard intake rate is especially disconcerting because the HHRA uses the standard intake rate to evaluate soil exposures to all other onsite chemicals. The outputs of the lead assessment are then compared to inappropriate non-conservative health levels (see comments 5, 37, 38, and 39).

The primary deficiency of Armco's Ecological Risk Assessment that it fails to adequately characterize the habitats and surrounding areas of each SWMU and AOC. The lack of adequate characterization leads to several potentially significant omissions and the resultant incomplete evaluation of ecological risk in and around each SWMU and AOC. Examples of significant omissions in the ERA include: exclusion of transport pathways carrying onsite contaminants to offsite habitats (i.e. soil to surface water bodies by overland flow), no specific descriptions of habitats in and around each SWMU and AOC (i.e. distance to nearest river, nearest wetland, etc.), no descriptions of specific receptors at each SWMU and AOC, and failure to consider bioaccumulation of contaminants to higher trophic levels through food chain exposures.

Finally, neither the human health nor the ecological risk assessments provide the entire data set for review, beginning instead with an abbreviated, post-screening list of chemicals. The complete impact of this deficiency cannot be exactly quantified, but it may have significant impact on the assessment and management of risk at the site. Without the entire list of chemicals for each evaluated SWMU and AOC, the risk manager cannot evaluate whether the chemical screening process was conducted appropriately and accurately. Finally, and perhaps most importantly, the risk manager cannot determine whether the detection limits for non-detected chemicals were adequately protective of human health and the environment.